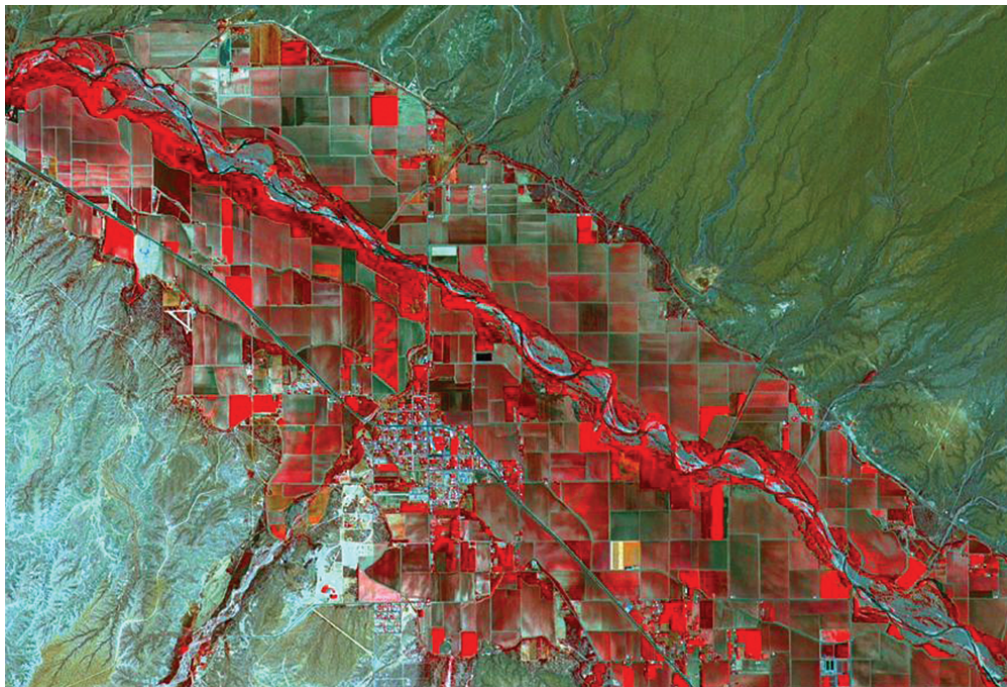




## Estimating Crop Acreage and Water Withdrawals for Crop Irrigation in Arizona Using Satellite Images and Aerial Photographs

Arizona is an arid State in which economic development is influenced largely by access to adequate water supplies. Water demand is met by pumping ground water from aquifers or by conveying surface water through a system of reservoirs and canals. Withdrawal data in Arizona are collected by Federal, State, and local government agencies as well as by private organizations. The U.S. Geological Survey (USGS), in cooperation with the Arizona Department of Water Resources (ADWR), published a series of reports from 1981–94 entitled "Annual Summary of Ground-Water Conditions in Arizona" that included ground-water withdrawals by basin.

Prior to 1991, ground-water withdrawals for irrigation of crops were estimated through the use of a method that utilized pump efficiencies and energy consumption. This method is no longer feasible and new methods are being used to estimate withdrawals. Withdrawals from 1991 to 2000 are being estimated on the basis of crop acreage, irrigation-requirement rates for crops, and irrigation efficiency. Crop-acreage data, by county, are supplied by the Arizona Agricultural Statistics Service. Irrigation-requirement rates are determined by using a modified Blaney-Criddle method to estimate consumptive use. Irrigation efficiency is based on irrigation efficiency data from the area of interest for 1980–90. County withdrawals are then disaggregated into the ground-water basins delineated by the ADWR. These basins, in most cases, cross county boundaries, and each county may include several basins. Irrigation withdrawals were disaggregated into basins on the basis of the spatial distribution of irrigated acreage as determined from satellite images and aerial photographs.



Satellite image of Safford, Arizona, June 9, 1997.

In 2000, the USGS, in cooperation with the ADWR, Natural Resources Conservation Service, and Bureau of Reclamation, prepared a map that shows agricultural lands in Arizona. Agricultural field boundaries were delineated on the basis of satellite images and aerial photographs to disaggregate county crop acreage and compile the data by ADWR ground-water basin. Field boundaries were delineated using land satellite (Landsat) Thematic Mapper (TM) images, Satellite Pour l'Observation de la Terra (SPOT), Digital Ortho Quads (DOQ-5), or Digital Orthophoto Quadrangles (DOQs), or combinations of these sources, to create a geographical information system (GIS) coverage. TM images (1993) were received from the Landsat 5 satellite and have a ground resolution of 30 meters. The SPOT satellite imagery has a ground resolution of 10 meters. Space Imaging's DOQ-5 product is a digital, orthorectified satellite imagery that is formatted into USGS 7.5-minute quadrangles and has a ground resolution of 5 meters. A DOQ is a computer-generated image of an aerial photograph in which the image displacement caused by terrain relief and camera tilt has been removed and has a ground resolution of 1 meter. Different satellite images and aerial photographs were used by different agencies for digitizing the field boundaries probably owing to the cost and availability of the images and photographs.

— Use of firm names is for identification only and does not constitute endorsement by the U.S. Geological Survey —

**For more information about the USGS water-use program in Arizona, please visit**  
<http://az.water.usgs.gov/projects/az007.html>, **or contact Saeid Tadayon at (520) 670-6671 x254**  
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**For more information about the USGS national water-use program in Arizona, please visit**  
<http://water.usgs.gov/watuse/>

**For more information about general water-resource activities of the USGS in Arizona, please visit**  
<http://az.water.usgs.gov>, **or contact the Arizona District Chief at (520) 670-6671 or**  
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